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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Philippe Armangau, et al.

Serial No.: 10/603,411 Confirm: 4172

Filed: 06/25/2003

For: Replication of Snapshot Using a File
System Copy Differential

Group Art Unit: 2168

Examiner: Jay Morrison

Atty. Dkt. No.: EMCR:0095NPU

Technology Center 2100

REPLY BRIEF TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

Sir:

This Reply Brief is in response to the Examiner's Answer dated Aug. 9, 2007, and is intended to address only new issues raised in the Examiner's Answer.

With respect to the 35 U.S.C. 102(e) rejection of appellants' claims [8, 33, and 54], the Examiner's Answer on pages 15 to 16 suggests that Goldstein is describing a loop of an incremental backup process over the sequence of copies, and another loop of difference lists indexing the blocks. In such a case, however, the loop indexing the blocks to create a difference list would be an inner loop, and the incremental backup process would be an outer loop, because the incremental backup process is continued successively over the difference lists. (Goldstein, paragraph [0024], lines 10-13, and paragraph [0043], lines 10-14.) This is the opposite of what is being called for in the appellants' claims 8, 33, and 54. This same confusion of "inner" and

“outer” occurs in the Examiner’s Answer on page 19 with respect to the 35 U.S.C. 103(a) rejection of appellants’ claims 16 [and 58].

With respect to the 35 U.S.C. 103(a) rejection of appellants’ claims 9 and 34 over Goldstein in view of Ohran, the Examiner’s Answer on page 17 says that the references to the data blocks A through E (of Ohran paragraph [0044], lines 7-11) are equivalent to the index claimed by the appellants. Appellants respectfully disagree. The fact that the subscripts “x” and “y” represent corrupted data as used in a patent specification (Ohran, page 4, paragraph [0037]) is not a disclosure of a snapshot copy facility having an index for each snapshot copy for indicating blocks of data that are known to be invalid in the snapshot copy. Instead, it is a disclosure of an example in which data blocks D_x and D_y are indicated by the patent draftsman to be invalid. Nor does this example in Ohran satisfy the limitation of “scanning the index for the specified younger one of the snapshot copies, and when the index indicates that a block is not known to be invalid, ...” in the appellants’ claimed method of operating the snapshot copy facility.

The Examiner’s Answer on page 17 further presumes that “only blocks which are not known to be invalid (i.e. valid data blocks) are included when scanning the index” when Goldstein produces a list of blocks that have changed between the snapshots. However, neither Goldstein nor Ohran scans an index for a specified younger one of the snapshot copies, such that the index indicates that a block is not known to be invalid. In the appellants’ claims, this

scanning of the index is separate and distinct from the additional and following claimed operation of “determining whether the block has changed between the specified older one of the snapshot copies and the specified younger one of the snapshot copies.” Moreover, the fact that there is an example in Ohran where “At this point, it is determined that the data 20b (A₁, B, C, D₁, E) represents valid, non-corrupted data.” (Ohran, paragraph [0045], lines 1-2)” does not suggest the appellants’ claimed scanning of an index for each snapshot copy for indicating blocks of data that are known to be invalid in the snapshot copy. In Ohran’s example, the determination that the data 20b (A₁, B, C, D₁, E) represents valid, non-corrupted data is performed by a different method; namely, by rolling back the data of the mass storage device to a state prior to the occurrence of the corrupted data block, as described in Ohran paragraph [0044].

Page 18 of the Examiner’s Answer refers to a meta bit map. A meta bit map is found in appellants’ claims 16, 41, and 59.

With respect to the 35 U.S.C. 103(a) rejection of claims 17, 42, and 60 over Goldstein in view of Ohran, appellants respectfully disagree with the argument in the Examiner’s Answer on page 20 for similar reasons in that neither Goldstein nor Ohran disclose both the claimed first index (indicating blocks of data that have changed between snapshots) and the claimed second index (indicating blocks of data that are not in use in each snapshot). In the context of appellants’ claims 17, 42, and 60, from the claimed use of the first index in combination with the second index, a block can be in use or not in use, and if in use, the block can be changed or not

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changed between snapshot copies. Therefore, the state of a block being in use or not in each snapshot copy is different from the state of a block being changed or not between snapshot copies.

In view of the above, the rejection of the appellants' claims should be reversed.

Respectfully submitted,

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EXAMINER

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.



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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Application Number: 10/603,411
Filing Date: June 25, 2003
Appellant(s): ARMANGAU ET AL.

MAILED

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Technology Center 2100

Richard C. Auchterlonie
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 4/10/2007 appealing from the Office action
mailed 1/10/2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Goldstein et al. (Publication Number US 2004/0163009), Ohran et al. (Publication Number US 2002/0112134).

(9) Grounds of Rejection

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 8,33 and 54 are rejected under 35 U.S.C. 102(e) as being anticipated by Goldstein et al. (Pub No. 2004/0163009) hereinafter "Goldenstein".

For claim 8, Goldenstein teaches "A method of operating a snapshot copy facility that stores a plurality of snapshot copies of a production file system, each of the snapshot

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copies being a prior state of the productionfile system at a respective point in time"(See paragraph [0029])

"the snapshot copy facility receiving a request for the difference between a specified older one of the snapshot copies and a specified younger one of the snapshot copies"

(See paragraph [0011] and [0024] wherein Goldstein's teaches include acquiring the difference between the base state snapshot and the data base volume snapshot as implied in applicant's claim language)

"the snapshot copy facility responding to the request by returning the difference between the specified older one of the snapshot copies and the specified younger one of the snapshot copies"(See paragraph [0030-0032] wherein Goldstein's teachings include the difference between the base state snapshot and the data base volume snapshot, as implied in applicant's claim language)

"wherein the snapshot copy facility has an index for each snapshot copy for indicating changes between said each snapshot copy and a next snapshot copy of the production file system, and the method includes scanning the index for the specified older one of the snapshot copies"(See paragraph [0029] and [0043] and fig. 10 of Goldstein's drawings illustrates the repetitive obtaining of a snapshot difference list, as implied in applicant's claim language)

"which includes scanning the indices for a sequence of the snapshot copies including the index for the specified older one of the snapshot copies and a respective index for each of a plurality of snapshot copies of the production file system that are both younger than the specified older one snapshot copies and older than the specified younger one

of the snapshot copies"(See paragraph [0027-0029] and fig. 3 Goldstein's drawings illustrates the base state snapshot and a subsequent series of data volume snapshots). "wherein the indices for the sequence of the snapshot copies are scanned by a program routine having an outer loop indexing blocks of data in the file system, and an inner loop indexing the snapshot copies in the sequence of the snapshot copies" (See paragraph [0011], [0024-0033], [00421-0043] and fig 3, 4, 6& 7 wherein Goldstein's teachings involve the determination of blocks that have changed, and also include indexing snapshot copies, thus teaches are synonymous).

As per claim 33, Goldstein teaches "storage for storing a plurality of snapshot copies of a production file system, each of the snapshot copies being a prior state of the production file system at a respective point in time"(See paragraph [0024] and [0029]) "and at least one processor programmed for receiving a request for the difference between a specified older one of the snapshot copies and a specified younger one of the snapshot copies" (See paragraphs [0011] and [0024] wherein Goldstein's teachings include acquiring the difference between the base state snapshot and the data base volume snapshot as implied in applicant's claim language) "and for responding to the request by returning the difference between the specified older one of the snapshot copies and the specified younger one of the snapshot copies" (See paragraphs [0030] and [0032] wherein Goldstein's teachings include the difference between the base state snapshot and the data base volume snapshot, as implied in applicant's claim language). "wherein the snapshot copy facility has an index for each snapshot copy for indicating

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changes between said each snapshot copy and a next snapshot copy of the production file system, and said at least one processor is programmed for scanning the index for the specified older one of the snapshot copies" (See paragraphs [0029] and [0043] and Fig 10 of Goldstein's drawings illustrate the repetitive obtaining of a snapshot difference list, as implied in applicants claim language).

"wherein said at least one processor is programmed for scanning the indices for a sequence of the snapshot copies including the index for the specified older one of the snapshot copies and a respective index for each of a plurality of snapshot copies of the production file system that are both younger than the specified older one snapshot copies and older than the specified younger one of the snapshot copies" (See paragraphs [0027] and [0028] and Fig.3 of Goldstein's drawings illustrates the base state snapshot and a subsequent series of data volume snapshots).

"wherein said at least one processor is programmed for scanning the indices for the sequence of the snapshot copies by a program routine having an outer loop indexing the blocks, and an inner loop indexing the snapshot copies in the sequence of the snapshot copies" (See paragraph [0011], [0024-0033]; [00421-0043] and fig 3, 4, 6& 7 wherein Goldstein's teachings involve the determination of blocks that have changed, and also include indexing snapshot copies, thus teaches are synonymous).

As per claim 54, Goldstein teaches "a program storage device containing a program for a snapshot copy facility the snapshot copy facility storing a plurality of snapshot copies of a production file system"(See paragraph [0024] and [0029]),

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"each of the snapshot copies being a prior state of the production file system at a respective point in time, wherein the program is executable for responding to a request for the difference between a specified older one of the snapshot copies and a specified younger one of the snapshot copies by returning the difference between the specified older one of the snapshot copies and the specified younger one of the snapshot copies"(See paragraphs [0011] and [0024] and [0027] and [0029] wherein Goldstein's teachings included identifying and producing a list of data blocks which differ between the subsequent snapshots, thus teachings are synonymous).

"wherein the snapshot copy facilities has an index for each snap shot copy for indicating changes between said each snapshot copy and a next snapshot copy of the production file system, and the program is executable for scanning the index for the specified older one of the snapshot copies" (See paragraphs [0029] and [0043] and Fig 10 of Goldstein's drawings illustrate the repetitive obtaining of a snapshot difference list, as implied in applicants claim language).

"wherein the program is executable for scanning the indices for a sequence of the snapshot copies including the index for the specified older one of the snapshot copies and a respective index for each of a plurality of snapshot copies of the production file system that are both younger than the specified older one snapshot copies and older than the specified younger one of the snapshot copies" (See paragraphs [0027] and [0028] and Fig 3 of Goldstein's drawings illustrates the base state snapshot and a subsequent series of data volume snapshots).

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"wherein the program is executable for scanning the indices for a sequence of the snapshot copies including the index for the specified older one of the snapshot copies and a respective index for each of a plurality of snapshot copies of the production file system that are both younger than the specified older one snapshot copies and older than the specified younger one of the snapshot copies" (See paragraphs [0027] and [0028] and Fig 3 of Goldstein's drawings illustrates the base state snapshot and a subsequent series of data volume snapshots).

"wherein the program is executable for scanning the indices for the sequence of the snapshot copies by a program routine having outer loop indexing the blocks, and an inner loop indexing the snapshot copies in the sequence of the snapshot copies" (See paragraph [0011], [0024-0033], [00421-0043] and fig 3, 4, 6& 7 wherein Goldstein's teachings involve the determination of blocks that have changed, and also include indexing snapshot copies, thus teaches are synonymous).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 9,16-18, 34, 41-43, 59, 60 and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goldstein in view of Ohran et al (Pub No. US 20020112134) (hereinafter Ohran).

As per claim 9, Goldstein teaches "a method of operating a snapshot copy facility that stores a plurality of snapshot copies of a production file system, each of the snapshot copies being a prior state of the production file system at a respective point in time"(See paragraph [0024] and [0029])"said method comprising:

"the snapshot copy facility receiving a request for the difference between a specified older one of the snapshot copies and a specified younger one of the snapshot copies" (See paragraphs [0030] and [0032] wherein Goldstein's teachings include the difference between the base state snapshot and the data base volume snapshot, as implied in applicant's claim language)"and the snapshot copy facility responding to the request by returning the difference between the specified older one of the snapshot copies and the specified younger one of the snapshot copies" (See paragraphs [0024]-[0029] and Fig 3&4).

Goldstein teaches, "determining whether there has been a change between the specified older one of the snapshot..., of the snapshot copies" (See paragraphs [0024]-[0028] and Fig 3 of Goldstein's drawings illustrates comparing the base state snapshot and a subsequent series of data volume snapshots. Wherein valid data volume is produced at a consistent state and comparing the based state snapshot and a

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subsequent series of data volume snapshots to confirm changes, which can only be done if block is valid).

Goldstein does not teach "wherein the snapshot copy facility has an index for each snapshot copy for indicating blocks of data that are know to be invalid in said each snapshot copy..."

However, Ohran's teachings and drawings illustrate writing invalid or corrupted data to certain data blocks in the mass storage device (See paragraph [0015], [0045] and [Fig 3])

Therefore, it would have been obvious at the time of the invention for one of ordinary skill in the art to have modify Goldstein by teachings of Ohran, wherein Ohran's teaches of separating invalid data, while a valid set of data is eventually used to reconstruct the invalid data, and been combined with Goldstein's method will enhance checking for changes of valid data.

As per claim 16, this claim is rejected on the grounds corresponding to the argument given above for rejecting claim 9 above including the following reasons:

"A method of operating a snapshot copy facility that stores a plurality of snapshot copies of a production file system, each of the snapshot copies being a prior state of the production file system at a respective point in time, the snapshot copy facility having an index for each snapshot copy for indicating blocks of data in the production file system that have changed between said each snapshot copy and a next snapshot copy of the production file system" See paragraphs [0011] and [0024] and [0027] and [0029]

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wherein Goldstein's teachings included identifying and producing a list of data blocks which differ between the subsequent snapshots, thus teachings are synonymous).

"scanning the indices for a sequence of the snapshot copies to determine the blocks that have changed between an older one of the snapshot copies and a younger one of the snapshot copies, the sequence of the snapshot copies including the older one of the snapshot copies and each of the snapshot copies that is both younger than the older one of the snapshot copies and older than the younger one of the snapshot copies" (See paragraphs [0027] and [0028] and Fig 3 of Goldstein's drawings illustrates the base state snapshot and a subsequent series of data volume snapshots).

"wherein the indices for the sequence of the snapshot copies are scanned by a program routine having an outer loop indexing respective blocks, and an inner loop indexing snapshot copies in the sequence of the snapshot copies" (See paragraph [0011], [0024-0033], [00421-0043] and fig 3, 4, 6& 7 wherein Goidstein's teachings involve the determination of blocks that have changed, and also include indexing snapshot copies, thus teaches are synonymous).

Goldstein teaches, "determining whether there has been a change between the specified older one of the snapshot..." (See paragraphs [0024]-[0029] and Fig 3 of Goldstein's drawings illustrates comparing the base state snapshot and a subsequent series of data volume snapshots. Wherein valid data volume is produced at a consistent state and comparing the based state snapshot and a subsequent series of data volume snapshots to confirm changes, which can only be done if block is valid).

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Goldstein does not teach "wherein the snapshot copy facility has a meta bit map for each snapshot copy for indicating blocks of data that are know to be invalid in ...".

However, Ohran's teachings and drawings illustrate writing invalid or corrupted data to certain data blocks in the mass storage device (See paragraph [0015] and [Fig 3])

Therefore, it would have been obvious at the time of the invention for one of ordinary skill in the art to have modify Goldstein by teachings of Ohran, wherein Ohran's teaches of separating invalid data, while a valid set of data is eventually used to reconstruct the invalid data, and been combined with Goldstein's method will enhance checking for changes of valid data.

For claim 34, this claim is rejected on grounds corresponding to the arguments given above for rejected claim 9 and is similarly rejected.

As per claim 41 this claim is rejected on the grounds corresponding to the argument given above for rejecting claims 16 above, including the following reasons:

Goldstein teaches "storage for storing a plurality of snapshot copies of a production file system, each of the snapshot copies being a prior state of the production file system at a respective point in time"(See paragraph [0024] and [0029])

"an index for each snapshot copy for indicating blocks of data in the production file system that have changed between said each snapshot copy and a next snapshot copy of the production file system" (See paragraphs [0011] and [0024] and [0027] and [0029])

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wherein Goldstein's teachings included identifying and producing a list of data blocks which differ between the subsequent snapshots, thus teachings are synonymous).
"at least one processor programmed for scanning the indices for a sequence of the snapshot copies to determine the blocks that have changed between an older one of the snapshot copies and a younger one of the snapshot copies, the sequence of the snapshot copies including the older one of the snapshot copies and each of the snapshot copies that is both younger than the older one of the snapshot copies and older than the younger one of the snapshot copies" (See paragraphs [0027] and [0028] and Fig 3 of Goldstein's drawings illustrates the base state snapshot and a subsequent series of data volume snapshots).

As per claim 59, this claim is rejected on the grounds corresponding to the argument given above for rejecting claim 16 above including the following reasons:

Goldstein teaches "a program storage device containing a program for a snapshot copy facility, the snapshot copy facility having a plurality of snapshot copies of a production file system, each of the snapshot copies being a prior state of the production file system at a respective point in time, and an index for each snapshot copy for indicating blocks of data in the production file system that have changed between said each snapshot copy and a next snapshot copy of the production file system" (See paragraphs [0011] and [0024] and [0027] and [0029] wherein Goldstein's teachings included identifying and producing a list of data blocks which differ between the subsequent snapshots, thus teachings are synonymous).

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"wherein the program is executable for scanning the indices for a sequence of the snapshot copies to determine the blocks that have changed between an older one of the snapshot copies and a younger one of the snapshot copies, the sequence of the snapshot copies including the older one of the snapshot copies and each of the snapshot Copies that is both younger than the older one of the snapshot copies and older than the younger one of the snapshot copies" (See paragraphs [0027] and [0028] and Fig 3 of Goldstein's drawings illustrates the base state snapshot and a subsequent series of data volume snapshots).

As per claim 17, 18, 42, 43, 60 and 61 Goldstein teaches "A method of operating a snapshot copy facility that stores a plurality of snapshot copies of a production file system, each of the snapshot copies being a prior state of the production file system at a respective point in time"(See paragraph [0029]) the snapshot copy facility having a first index for each snapshot copy for indicating blocks of data in the production file system that have changed between said each snapshot copy and a next snapshot copy ..." (See paragraphs [0029] and [0043] and Fig 10)

Goldstein teaches "responding to a request for the difference between a specific older one of the snapshot copies and a specified younger one of the snapshot copies...snapshot copies and older than the younger one of the snapshot copies". (See paragraph [0030-0032] wherein Goldstein's teachings include the difference between the base state snapshot and the data base volume snapshot, as implied in applicant's claim language).

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Goldstein does not teach "the snapshot copy facility having a second index for each snapshot copy for indicating blocks of data that are not in use" Ohran teachings include writing invalid or corrupted data to a certain data block. Wherein the abstract states data loss could be caused by data blocks becoming corrupt or lost, therefore data not in use is equivalent to data loss. (See paragraph [0015] and Fig 3)

It would have been obvious at the time of the invention for one of ordinary skill in the art to have modified Goldstein by the teachings of Ohran, to access the first and second index before checking for changes between the snapshot copies.

(10) Response to Argument

With regard to Applicant arguments regarding the 35 U.S.C. 102(e) rejection of claims 9 and 34 over Goldstein et al. ('Goldstein' hereinafter) (Publication Number 2004/0163009), it is respectfully submitted that this reference does in fact teach these claims. Applicant argues that Goldstein does not teach scanning a plurality of snapshot copies to determine the blocks that have changed between different snapshot copies, using an outer loop indexing blocks and an inner loop indexing snapshot copies in the sequence of copies. However, Goldstein teaches:

"File recovery is best accomplished when a precedent physical incremental backup has been performed. This process is illustrated in FIG. 7, where a base state snapshot difference list 141 (S_{10}) in state snapshots (i.e., $S_1 \rightarrow S_0$) is generated by identifying all segments of the base state snapshot 111 that are different from the first state snapshot 113. A base state backup 151 (B_{10}) is

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made by copying from the first state snapshot 113 all the data blocks identified in the base state snapshot difference list 141." (paragraph [0042])

The above citation generates a difference list between snapshots, where the list of blocks teaches the indexing of blocks as claimed by the Applicant. It is clear, since the blocks are identified, that an index into the snapshot exists so that the blocks themselves can be identified for inclusion into the difference list. Goldstein further discloses:

"The precedent physical incremental backup process is continued to obtain a second precedent snapshot difference list 145 (S_{32}) and a second precedent backup 155 (B_{32}), and a third precedent snapshot difference list 147 (S_{43}) and a third precedent backup 157 (B_{43}) in a similar manner." (paragraph [0043], lines 10-15)

This citation described the looping described in the Applicant's claim, where the incremental backup process is over the sequence of copies (inner loop in Applicant's claim) and the difference lists are the indexing of blocks (outer loop in Applicant's claim). Therefore Goldstein discloses the limitation.

With regard to Applicant arguments regarding the 35 U.S.C. 103(a) rejection of claims 9 and 34 over Goldstein in view of Ohran et al. ('Ohran' hereinafter) (Publication Number 2002/0112134), it is respectfully submitted that these references do in fact teach these claims. Applicant argues that Ohran does not teach "wherein the snapshot copy facility has an index for each snapshot copy for indicating blocks of data that are known to be invalid in said each snapshot copy", but it is noted that Ohran discloses:

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"Thus, the resulting data representing the state of the mass storage device at $T_{1,2}$ is (A₁, B, C, D_x, E) 20c. Because data blocks 20c also include corrupted data block D_x, it is determined that the set of data blocks 20c represent corrupted data." (paragraph [0044], lines 7-11)

In this citation, the references to the data blocks as A thru E are equivalent to the index claimed by the Applicant, and further it is clear that Ohran teaches determining that certain data blocks represent corrupted data and notes these data blocks with the 'X' subscript.

Applicant further argues that Goldstein does not teach "and the method includes scanning the index for the specified younger one of the snapshot copies, and when the index indicates that a block is not known to be invalid, then determining whether the block changed between the specified older one of the snapshot copies and the specified younger one of the snapshot copied", however Goldstein discloses:

"The snapshots 57 are compared by a processing unit 53, as explained in greater detail below, to produce a list of blocks that have changed between the snapshots 57 so that those blocks may be copied into backups 59." (paragraph [0024], lines 10-13)

In this citation, Goldstein describes producing a list of blocks generated by comparing older and younger snapshots. Regarding the fact that only blocks which are not known to be invalid (i.e. valid blocks) are included when scanning the index, this portion of the limitation comes from the Ohran reference:

"At this point, it is determined that the data 20b (A₁, B, C, D₁, E) represents valid, non-corrupted data." (paragraph [0045], lines 1-2)

Clearly the above citation, further considering the citation from Ohran previously presented (paragraph [0044], lines 7-11), discloses that blocks known to be valid are

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only selected. Therefore the combination of Goldstein and Ohran clearly discloses the limitation.

Regarding Applicant's argument that it would not have been obvious to combine these two references, it is respectfully submitted that both are in the same field of endeavor (backing-up and restoring data) and both speak to using snapshots of the storage in restoring the data. Further, Ohran offers motivation to improve Goldstein reference:

"Recognizing the commercial value of reliable computer data, businesses seek ways to protect their data and to reconstruct data that has become corrupt unreliable, or lost." (paragraph [0007], lines 1-3)

So it is clear that there is ample reason to combine these two references in the ways described.

Further regarding claims 9 and 34, the Applicant argues that in the Appellants teaching it is desirable to use a meta bit map and the various reasons why that is so. Respectfully, a meta bit map is not found in either claim and therefore not required to be taught, and the references relied upon teach the claimed limitations.

With regard to Applicant arguments regarding the 35 U.S.C. 103(a) rejection of claims 16, 41 and 59 over Goldstein in view of Ohran, it is respectfully submitted that these references do in fact teach these claims. Specifically, the Applicant argues that Goldstein does not teach scanning snapshot copies to determine the blocks that have changed between different snapshot copies, using an outer loop indexing blocks and an

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inner loop indexing snapshot copies in the sequence of copies. However, Goldstein

teaches:

"File recovery is best accomplished when a precedent physical incremental backup has been performed. This process is illustrated in FIG. 7, where a base state snapshot difference list 141 (S_{10}) in state snapshots (i.e., $S_1 \rightarrow S_0$) is generated by identifying all segments of the base state snapshot 111 that are different from the first state snapshot 113. A base state backup 151 (B_{10}) is made by copying from the first state snapshot 113 all the data blocks identified in the base state snapshot difference list 141." (paragraph [0042])

The above citation generates a difference list between snapshots, where the list of blocks teaches the indexing of blocks as claimed by the Applicant. It is clear, since the blocks are identified, that an index into the snapshot exists so that the blocks themselves can be identified for inclusion into the difference list. Goldstein further discloses:

"The precedent physical incremental backup process is continued to obtain a second precedent snapshot difference list 145 (S_{32}) and a second precedent backup 155 (B_{32}), and a third precedent snapshot difference list 147 (S_{43}) and a third precedent backup 157 (B_{43}) in a similar manner." (paragraph [0043], lines 10-15)"

This citation described the looping described in the Applicant's claim, where the incremental backup process is over the sequence of copies (inner loop in Applicant's claim) and the difference lists are the indexing of blocks (outer loop in Applicant's claim). Therefore Goldstein discloses the limitation.

With regard to Applicant arguments regarding the 35 U.S.C. 103(a) rejection of claims 17, 42 and 60 over Goldstein in view of Ohran, it is respectfully submitted that

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these references do in fact teach these claims. Applicant argues that the references do not teach a first index indicating blocks that have changed between snapshots.

However, Goldstein teaches:

"File recovery is best accomplished when a precedent physical incremental backup has been performed. This process is illustrated in FIG. 7, where a base state snapshot difference list 141 (S_{10}) in state snapshots (i.e., $S_1 \rightarrow S_0$) is generated by identifying all segments of the base state snapshot 111 that are different from the first state snapshot 113. A base state backup 151 (B_{10}) is made by copying from the first state snapshot 113 all the data blocks identified in the base state snapshot difference list 141." (paragraph [0042])

The difference list in the above citation is equivalent to the claimed first index indicating blocks that have changed.

Applicant further argues that the references do not teach a second index which indicates blocks of data that are not in use in each snapshot copy. To teach this limitation, Ohran discloses:

"As shown in FIG. 3, the data blocks 20 stored in mass storage device at T_0 are designated as (A, B, C, D, E). At $T_{1.0}$, the computer 10 in FIG. 2 issues a write request, whereby data block 30 (A_1) is to overwrite existing the data block A, resulting in a set of data blocks 20a (A_1 , B, C, D, E)." (paragraph [0034], lines 5-11)

Examining the blocks that are not overwritten, we see that Ohran has disclosed an index of blocks of data which have not been changed and are therefor not in use, which is stored at time $T_{1.0}$ and discloses the limitation.

With regard to Applicant arguments regarding the 35 U.S.C. 103(a) rejection of claims 18, 43 and 61 over Goldstein in view of Ohran, it is respectfully submitted that

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these references do in fact teach these claims. Specifically, applicant argues that these references do not teach accessing the indices of snapshots to determine whether at least one of the blocks has changed between the older and younger of the snapshots.

To address this limitation, Goldstein teaches:

"It can then be verified that the resulting consolidated backup is equivalent to a full second state backup B₂ (not shown) by comparing its contents with the contents of the second state snapshot 115 while the second state is snapshot 115 is still online." (paragraph [0036], lines 11-15)

This citation shows how Goldstein determines whether the contents of two different snapshots are equivalent and whether at least one of the blocks has changed, which teaches the limitation.

Conclusion:

It is respectfully submitted that a combination of the references cited disclose the claimed differential snapshot system. In light of the forgoing arguments, the examiner respectfully requests the honorable Board of Appeals and Interferences to sustain the rejection.

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(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

Respectfully submitted,

/Jay Morrison/

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